



Altered developmental trajectories for impulsivity and sensation seeking among adolescent substance users



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HIGHLIGHTS

- We model the development of impulsivity and sensation seeking in youth age 11–15.
- Sensation seeking increased and impulsivity decreased as youth matured.
- Preadolescent impulsivity and sensation seeking were higher among substance users.
- Developmental trajectories for substance users and non-users differed.

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ABSTRACT

A number of studies have associated impulsivity and sensation seeking with level of substance use and risk for developing a substance use disorder. These relationships may be particularly apparent during adolescence, when developmental changes in impulsivity and sensation seeking occur at the same time as increased opportunities for substance use. To examine this, the current study measured impulsivity and sensation seeking from pre-adolescence to mid-adolescence in a sample of youth, the majority of whom were identified as being at risk for developing a substance use disorder based on their family history of substance use disorders. Youth were separated into those who did ($n = 117$) and did not ($n = 269$) initiate substance use by mid-adolescence. Results showed that substance users were more impulsive and more sensation seeking during pre-adolescence, prior to any significant substance use, and that greater sensation seeking in pre-adolescence was related to heavier substance use by mid-adolescence. In addition, developmental trajectories for substance-using youth showed a greater increase in sensation seeking but a more modest decrease in impulsivity from pre-adolescence to mid-adolescence. Taken together, these results indicate that increased impulsivity and sensation seeking is apparent in adolescent substance users as early as pre-adolescence, that the difference between substance users and non-users becomes larger across early adolescence as their developmental trajectories diverge, and that greater sensation seeking in pre-adolescence may predict increased substance use by mid-adolescence.

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1. Introduction

Substance abuse often begins during adolescence and is influenced by many aspects of an individual's personality and environment. Two traits that have frequently been associated with substance abuse are impulsivity and sensation seeking (e.g. Bjork, Hommer, Grant, & Danube, 2004; Coffey, Gudleski, Saladin, & Brady, 2003; Fischer &

Smith, 2008; Gerra et al., 2004; La Grange, Jones, Erb, & Reyes, 1995; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Impulsivity can be conceptualized as a tendency to act in unplanned ways without considering the potential negative consequences of one's actions (Moeller et al., 2001). Sensation seeking is a related but distinct trait that is defined as interest in varied, novel, and intense experiences, as well as a willingness to take risks to have such experiences (Zuckerman, 1994). Factor analysis suggests that sensation seeking and impulsivity are distinct factors (Whiteside & Lynam, 2001), but that both contribute to behavioral outcomes (Steinberg et al., 2008). The relationship between these two factors and negative outcomes such as substance abuse may be particularly apparent during adolescence, when there are normative

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changes in impulsivity and sensation seeking at the same time that the risk for initiating substance use increases sharply. Research on the developmental trajectories of impulsivity and sensation seeking during adolescence has shown that sensation seeking increases from late childhood to mid-adolescence (Galvan, Hare, Voss, Glover, & Casey, 2007; Spear, 2000; Steinberg et al., 2008; Trimpop, Kerr, & Kirkcaldy, 1998; Zuckerman, 1994), whereas impulsivity declines from late childhood through adolescence (Casey, Jones, & Hare, 2008; Leshem & Glicksohn, 2007; Steinberg et al., 2008). However, there is limited empirical research investigating how these two traits develop across adolescence and in relation to substance use.

Much of the evidence relating impulsivity and sensation seeking to problematic substance use is from cross-sectional studies of substance users and non-users. For example, individuals with substance use disorders are more impulsive (Bjork et al., 2004; Coffey et al., 2003; Dom, D'haene, Hulstijn, & Sabbe, 2006; Li, Milivojevic, Kemp, Hong, & Sinha, 2006; Moeller et al., 2001, 2002) than are individuals with no history of substance use disorder. In addition, sensation seeking has been positively correlated with amount of alcohol and illicit drug use in adolescents and young adults (Fischer & Smith, 2008; Gerra et al., 2004; La Grange et al., 1995). However, these studies only provide evidence of differences that are present among individuals who are already substance users. They are unable to provide insight into whether substance users differ on these traits prior to substance use, or how developmental trajectories of impulsivity and sensation seeking differ between those who use substances and those who do not. Further research is needed to better understand how developmental trajectories for impulsivity and sensation seeking relate to substance use during adolescence.

The dual systems model of adolescent development provides a framework for understanding why the developmental trajectories of impulsivity and sensation seeking may relate to adolescent substance use. According to this theory, changes related to brain maturation from childhood to adulthood lead to an increase in sensation seeking tendencies during adolescence that combines with still-immature impulse control abilities (Steinberg et al., 2008). It is thought that this elevated sensation seeking increases an adolescent's interest in potentially rewarding behaviors such as substance use, while poorer impulse control increases the likelihood of acting on these desires. This is supported by the general finding that adolescents engage in more risky behaviors, including substance use, than do other age groups (Gardner & Steinberg, 2005; Spear, 2000). The dual systems model was developed as a general model of developmental processes that occur in all individuals from childhood through adulthood. However, there is individual variation in the timing and degree of changes between individuals (e.g., Harden & Tucker-Drob, 2011), such as having an earlier age at which changes begin or a greater amount of total change. These differences may relate to risk for substance use involvement.

To test whether variability in the development of impulsivity and sensation seeking from pre-adolescence to mid-adolescence relates to risk for developing a substance use disorder, we previously examined changes in these traits in a longitudinal study of youth with high (FH+) and low (FH-) risk for developing a substance use disorder based on their family history. One aim of this study was to determine whether differences in developmental trajectories for impulsivity and sensation seeking might explain the higher risk for developing a substance use disorder among FH+ individuals. Another aim was to investigate whether FH+ youth who initiated substance use before age 15 differed from non-using FH+ and FH- youth. This group of youth was selected because they possess two characteristics that increase their risk for developing a substance use disorder: they are FH+ and they initiated substance use prior to age 15, which has previously been associated with increased risk of developing a substance use disorders (SAMHSA, 2012). We found that FH+ youth were more impulsive in pre-adolescence than were FH- youth, and that this difference remained across development. When FH+ youth with early substance use initiation were compared to FH+ and FH- youth with no substance use, we

found that FH+ youth with early substance use initiation had the smallest decreases in impulsivity and greatest increases in sensation-seeking across development (Redacted for review, 2015). These findings suggest that youth with early substance use initiation and familial histories of substance use disorders display altered developmental trajectories that involve higher levels of impulsivity and sensation seeking during early to mid-adolescence. However, it is not known whether this result is specific to very high-risk users (i.e., FH+ youth with early substance use initiation), or whether a similar result can be found when looking at substance-using adolescents more generally (i.e., including FH- substance users and users with later onset of use). Additionally, the previous study focused on initiation rather than amount of substance use. Therefore, it is not known whether adolescents with relatively heavier substance use (i.e., ≥ 5 times) differ from those who have simply initiated use. This is an important distinction because the overall amount of substance use, experiencing negative consequences of substance use, and binge drinking during adolescence have been related to poorer outcomes longitudinally (D'Amico, Ellickson, Collins, Martino, & Klein, 2005; Hill, White, Chung, Hawkins, & Catalano, 2000). Specifically, youth in previous research who displayed these behaviors were more likely to experience short-term consequences such as commit crimes, less likely to graduate from high school or be gainfully employed, less likely to be close with their family, and more likely to be diagnosed with a substance use disorder in adulthood. In addition, substance use during adolescence is associated with a range of short-term negative outcomes, such as auto accidents, overdoses, risky sexual behavior, and suicide (Toumbourou et al., 2007). If developmental trajectories for impulsivity and sensation seeking differ in a broader sample of adolescent substance users vs. non-users, or distinguish those who engage in more problematic substance use vs. those who only try a substance once or twice, then interventions could be developed to identify altered trajectories early on and to target the youth most at risk.

To address the gap of limited research on developmental trajectories of impulsivity and sensation seeking among adolescent substance users and non-users, and to extend our previous findings relating altered developmental trajectories to early-onset substance use in at-risk youth, the current study was designed to examine impulsivity and sensation seeking from pre-adolescence to mid-adolescence in substance-using and non-using youth. The first aim of this study was to extend our previous work on developmental trajectories of impulsivity and sensation seeking to determine whether our findings regarding FH+ youth with early substance use initiation can be replicated in a more general sample of adolescent substance users. A second aim was to examine whether these patterns differed between adolescents with relatively higher and lower levels of substance use. It was hypothesized that heavier substance users (i.e., ≥ 5 uses) would show altered developmental trajectories in impulsivity and sensation seeking compared to lighter users, and that non-users would show developmental trajectories that most closely resemble the typical developmental pattern suggested by the dual systems model.

2. Method

2.1. Participants

Three hundred and eighty six youth (187 boys, 199 girls), initially ages 10–12 years old, who were enrolled in a longitudinal study of adolescent development and substance use were included in this study. Details about sample characteristics and recruitment are described elsewhere (Redacted for review, In Press). Briefly, families were initially recruited between 2010 and early 2013 using radio and online advertisements in a large southwestern U.S. city. Following initial enrollment, participants were tested at 6-month intervals and this testing is still ongoing. At the time of the current analyses, families had been followed for a maximum of 54 months (Median = 36.0 mo). Participants

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